**How to Cite**:
Aymene, B. M., & Mounir, L. (2024). The role of green start-ups in the transition to a circular economy: International experiences. *International Journal of Economic Perspectives*, *18*(2), 442–453. Retrieved from https://ijeponline.org/index.php/journal/article/view/570

# The role of green start-ups in the transition to a circular economy–International experiences

**Boudendouna Mohammed Aymene**
Laboratory of economics of organizations and sustainable development, University of Jijel, Algeria
Email: doc.aymene2022@gmail.com

**Louadj Mounir**
Laboratory of economics of organizations and sustainable development, University of Jijel, Algeria
Email: m.louadj@univ-jijel.dz

***Abstract*---**Amidst escalating environmental crises, such as global warming, numerous organizations have initiated quests for viable solutions to these distressing phenomena. The escalating global temperatures and the consequential issues have catalysed opportunities for innovators and pioneers to contribute towards sustainable development, encompassing its three critical dimensions: social, environmental, and economic. This impetus has given rise to sustainable enterprises or green start-ups, though these firms are predominantly still in their embryonic stages, particularly in Arab nations, and notably in Algeria. The nascent state of these companies can be attributed to inadequate funding, primarily due to investors' hesitancy to allocate resources towards them and the legal ambiguities that currently envelop these green startups.

***Keywords*---**Global warming, Green startups, Sustainable development.
**JEL classification codes**: Q5, Q57.

## Introduction

Our planet is currently besieged by numerous anthropogenic environmental challenges. These challenges adversely affect the quality of life and economic stability. The root causes of these environmental issues stem from economic entities, which in the past, encountered an environmental dilemma known as the ozone hole. This issue was precipitated by the production of Chloro Fluoro Carbons (CFCs), also commercially recognized as Freonn, a human-made,


***Corresponding author***: *Aymene, B. M., Email: doc.aymene2022@gmail.com*
*Submitted: 05 April 2024, Revised: 28 July 2024, Accepted: 19 August 2024*

ostensibly non-toxic substance. Freon found applications in a variety of products, including refrigerators, spray paints, pesticides, and hair conditioners.

As Freon degrades within the atmosphere, it disrupts the molecular integrity of ozone, a molecule composed of three oxygen atoms, thereby exacerbating the ozone hole. Nonetheless, due to the 1987 Montreal Protocol, which mandated the phased discontinuation of these substances, the ozone hole is on a trajectory towards natural recovery, anticipated to complete by 2040.

Frequently, when an environmental catastrophe appears imminent, underscored by an array of studies and scientific investigations, a clash arises between large-scale corporations and the scientific community. This conflict stems from the significant profits these companies derive from producing goods in a conventional linear (grey) economy, a practice conclusively linked to yet another environmental calamity, global warming.

Global warming, propelled by carbon emissions from extensive industrial activities, contributes to the melting of polar ice caps, which in turn elevates global sea levels, ultimately threatening coastal regions with submersion and precipitating profound economic disruptions.

The shift from a linear to a circular (green) economy aimed at preserving natural resources and fostering environmental and social progress alongside economic growth, has expedited the emergence of environmentally conscious companies, or green companies.

This shift has been prominently advocated in various summits by leading nations, such as the G20, which has urged industrial entities to transition towards greener operational modalities and has bolstered entrepreneurs and innovators in the field.

Despite these advancements, green startups continue to encounter formidable challenges in securing establishment due to the general scarcity of funding for new ventures and, more specifically, for green-oriented enterprises. Banks and investors typically withhold financial support until these companies demonstrate their market viability. Consequently, at the conclusion of their initial development phase, many startups find themselves depleted of capital, persistently seeking new funding opportunities to sustain and expand their operations.

**Main Study Problem**

**Sub-Problems:**

- What pivotal role do green startups play in facilitating the transition from a traditional grey economy to a sustainable green economy?
- To what extent does the grey economy contribute to the exacerbation of global warming?
- What strategic steps are necessary for transitioning from a linear economy to a circular economy?
- What are the fundamental requirements for establishing a robust green economy?
- In what ways can startups, particularly those with a workforce of one to ten employees, make significant contributions to the green economy?
- What are the critical funding phases that green startups must navigate to

achieve sustainability?

**Study Hypotheses:**

- The linear (grey) economy has substantially contributed to environmental degradation since the onset of the first industrial revolution.
- The shift towards a circular economy is facilitated through the effective recycling of waste materials and the management of carbon emissions.
- Corporate social responsibility regarding environmental stewardship plays a crucial role in the advancement of the circular economy.
- Large industrial corporations have played a supportive role in nurturing green startups, enabling the realization of innovative ideas.
- There exist green startups that struggle to meet ongoing operational demands due to challenges in securing adequate financing.
- The legal framework in Algeria has not adequately recognized the vital environmental and societal roles that startups should play.

**Importance of the Study:**

The significance of this research is derived from the criticality of its subject matter. Global warming and associated environmental challenges have transcended the confines of scientific debate to become central concerns for policymakers and societal leaders. Thus, the relevance of this study is underscored by its evolution into a global issue that demands action from all societal segments. The importance of this study is further articulated through several key aspects:

- Unravelling the causes behind the acceleration of global warming.
- Emphasizing the significance of the circular economy in sustaining human life and the instrumental role green startups play in its realization.
- Illuminating the limitations of the linear economy in addressing environmental challenges through innovative green startups.

**Study Objectives:**

The objectives of this research are to elucidate and explore potential strategies for transitioning to a circular economy. This transition is crucial for a country like Algeria, which seeks to diversify its economic base beyond the reliance on fluctuating hydrocarbon revenues.

**Study Methodology:**

- Examining the role of green companies in fostering economic diversification.
- Assessing the contribution of green companies towards achieving sustainable development goals.
- Highlighting the impact of startups on the dimensions of social responsibility.
- Promoting and facilitating the adoption of green innovations and their integration into the market.

The methodology of this study employs a descriptive approach initially, followed by a comprehensive analytical exploration. This approach involves detailing the environmental disasters previously encountered by our planet and presenting data on international companies that have made significant strides towards embracing the circular economy.

## 2. Transition from a Linear to a Circular Economy:

Historically, both organizations and individuals have predominantly operated within the confines of a linear or grey economy, characterized by a sequential process of mining and extraction, followed by manufacturing, utilization, and ultimately, the disposal of waste and by products into the environment. This traditional economic model has not only led to the excessive depletion of our planet's finite natural resources but has also exacerbated climate issues through increased carbon emissions during successive industrial revolutions. These emissions have significantly altered natural climatic processes, evidenced by rising global temperatures and shifts in the timing of seasonal rainfall patterns, among other environmental disturbances.

### 2.1 Definition of the Green Economy:

In 2008, the United Nations Environment Programme (UNEP) inaugurated the Green Economy Initiative (GEI), a comprehensive global research program aimed at motivating policymakers to foster investments that benefit the environment. By 2015, UNEP had advanced its efforts with the publication "Unveiling Pathways to Inclusive Green Economies."
Within this framework, UNEP proposed a pragmatic definition of the green economy as an economic system that not only leads to improved human well-being and social equity but also significantly diminishes environmental risks and ecological scarcities.
More precisely, the green economy is delineated as an economic paradigm wherein growth in income and employment is propelled by both public and private investments focused on reducing carbon emissions, curbing pollution, enhancing energy and resource efficiency, and averting the loss of biodiversity and ecosystem services (Agency, 2022).
The essence of the green economy lies in its ability to reorient and recalibrate economic activities towards greater environmental and social sustainability. The interplay between the green economy and sustainable development is akin to the relationship between a component and its assembly; sustainable development is the overarching objective nations aim to achieve, while the green economy provides the actionable framework that supports this pursuit without supplanting it (Hdaddou, 2021, p. 5).

### 2.2 Reasons for Transitioning from a Linear to a Circular Economy:

The escalation of Earth’s atmospheric temperature, primarily driven by an increase in greenhouse gas concentrations beyond natural levels due to industrial activities, has been a significant catalyst for global warming. This phenomenon has induced a rise in Earth's average temperature by approximately one degree Celsius, a climatically substantial increment for our planet.

#### 2.2.1 Definition of Global Warming:

Global warming describes the process by which the Earth's atmosphere retains a portion of the sun's energy to warm the planet, a mechanism vital for maintaining climatic balance. The mean global temperature is approximately 14 degrees Celsius. In the absence of the global warming effect, Earth's average temperature would plummet to around -19 degrees Celsius, illustrating the critical role of global warming in moderating Earth’s climate (Nabhane, 2013).
The principal mechanism behind global warming involves the absorption of the sun's rays, which include ultraviolet light, by the Earth's surface. These rays are subsequently re-emitted as infrared rays back into the atmosphere, where they are trapped by greenhouse gases, predominantly carbon dioxide, which is extensively emitted by industrial factories.

#### 2.2.2 Key Greenhouse Gases Affecting Global Warming:

The concept of "global warming" emerged around two centuries ago, coinciding with the dawn of the Industrial Revolution. Five primary greenhouse gases are predominantly

responsible for absorbing and retaining solar heat, thus elevating the Earth's temperature beyond its natural average.
These pivotal gases are carbon dioxide, water vapor, ozone, nitrogen gas, and methane (Kamar, 2012).

Table 01: Greenhouse gases

| N° | Name | Source | Chemical Symbol |
|---|---|---|---|
| 1 | Water vapor | A climate reaction, represented by the evaporation of water | H2O |
| 02 | Carbon Dioxide | Burning organic materials such as coal, oil, gas, wood, and solid waste | CO2 |
| 03 | Methane | Natural gas, petroleum industries, agricultural places | CH4 |
| 04 | Nitrogen gas | Agriculture, livestock, fertilizers, agricultural waste, fuel combustion | N2O |
| 05 | Ozone gas | Air pollution | O3 |

Source: Prepared by researchers

In addition to these, industrial gases, including various fluorinated compounds, exhibit a warming potential that vastly exceeds that of carbon dioxide. These compounds can linger in the atmosphere for millennia and are responsible for approximately 2% of all greenhouse gas emissions (Mann, 2022).

### 2.2.3 Effects of Global Warming on Earth:

The augmentation of these greenhouse gases has several dire consequences:

- Rising sea levels, propelled by the melting of ice caps and the thermal expansion of warming oceans.
- Significant impacts on freshwater reserves, crucial for human and ecological sustenance.
- Adverse effects on agriculture, manifesting through diminished soil fertility and shifts in rainfall patterns, which in turn affect crop yields.
- The creation of environments conducive to the spread of diseases and epidemics, exemplified by increased mosquito proliferation, which can lead to a rise in malaria cases (Kamar, 2012, p. 85).

## 2.3 International Efforts to Address Global Warming:

Numerous countries have endeavoured to tackle the multifaceted challenges posed by global warming, precipitated by economic activities and human actions that degrade ecosystems. These environmental stresses contribute to the melting of polar ice caps, the elevation of sea levels, and pose threats to coastal and agricultural communities, potentially triggering migration and economic adversities.

### 2.3.1 The 2015 Paris Climate Agreement:

Recognized globally as a crucial step towards mitigating climate change, the Paris Agreement encompasses 197 countries. It was officially adopted on December 12, 2015, and became effective shortly thereafter. The agreement is structured to:

- Confront climate change, acknowledging it as a collective responsibility that varies based on each nation's capabilities.
- Foster the shift towards a carbon-neutral economy by promoting technological innovation and adaptation.
- Limit the global temperature increase to below two degrees Celsius, while striving to further restrict it to 1.5 degrees Celsius.

- Encourage the 195 signatory countries to formulate strategies aimed at minimizing greenhouse gas emissions over the long term (Nations, 2021).

A central aspect of the Paris Agreement is the broad commitment by nations to diminish greenhouse gas outputs and champion a transition towards a green economy, thereby urging economic entities to reduce carbon emissions and adopt circular economic practices.

### 2.3.2 G20 Summit 2020 in Saudi Arabia:

The Group of Twenty (G20), also known as the Global Forum for Economic Cooperation, consists of the world's twenty most significant economic entities, including nineteen countries and the European Union. Collectively, they account for approximately 90% of global economic output and 80% of international trade, encompassing the world's largest economies such as the United States, with a GDP exceeding 20 trillion dollars, and China, with a GDP of about 13 trillion dollars. Established in 1999, the G20 aims to enhance international financial stability. A notable resolution from the 2020 summit in Saudi Arabia was the advocacy for achieving net-zero emissions through an approach termed the Four R (4R):

- **Reducing Carbon Emissions:** Implementing renewable energy sources, enhancing energy efficiency, and promoting the use of clean fuels such as green hydrogen.
- **Carbon Capture**: Maximizing carbon capture from industrial outputs and re-injecting it into oil and gas reservoirs to increase their productivity.
- **Carbon Recycling:** Reusing captured carbon in the manufacturing processes, particularly within industries such as automotive.
- **Carbon Removal**: Actively removing carbon dioxide from the atmosphere, as demonstrated by initiatives like Saudi Aramco's project to plant over two million mangrove trees, which absorb significant amounts of carbon dioxide.

The G20 summit discussions also emphasized:

- Providing equitable opportunities for all demographics, particularly youth, women, and small to medium enterprises, and utilizing technology to bolster financial inclusion.
- Promoting the role of emerging technologies in supporting the digital economy and enhancing the efficacy of global economic mechanisms (agreement, 2021).

#### 2.3.2.1 Role of Saudi Aramco in the Circular Economy:

Acknowledging the pervasive threat of global warming, which transcends the boundaries of climate science to engage all societal tiers, from politicians to the general populace, corporate giants like Saudi Aramco have embraced their pivotal role. In 2021, amidst the global shifts induced by the COVID-19 pandemic, the G20 summit convened virtually in Rome, Italy.

This assembly aimed to amplify and extend the environmental commitments previously established in Saudi Arabia. Central to these commitments was the innovative utilization or complete eradication of carbon emissions across diverse industries. Several economic entities have markedly contributed to the alleviation of global warming by curbing their carbon outputs. These efforts underscore their commitment to fostering a green economy and reflect a profound sense of social responsibility that spans economic, interpersonal, and societal dimensions. This environmental consciousness has spurred entrepreneurs globally to innovate continuously, thereby catalysing the creation of sustainable business models and the flourishing of startups in recent years.

## 3. Definition of Startups

At its core, innovation entails crafting solutions to specific, often complex, problems. Entrepreneurs and innovators delve into identifying both economic and social challenges, striving to address them innovatively. This process has led to the advent of startups, which

are increasingly recognized for their investment potential and critical role in sustainable development.

**3.1 Definition of Startups for Entrepreneurs:**

Eric Ries, the progenitor of the Lean Startup methodology, defines a startup as a human institution designed to develop new products or services under conditions of profound uncertainty (Ries, 2011, p. 37).
Wil Schroter further elaborates, describing a startup as "the living embodiment of a founder's dream, representing the journey from concept to reality. It stands as one of the rare opportunities to transform a mere dream into tangible reality, not only for the dreamer but for the world at large."

**3.2 Definition of Startups in Algerian Legislation:**

In an effort to formalize and support the burgeoning startup ecosystem, the Algerian government enacted Executive Decree No. 254/20 on September 15, 2020. This legislation aims to clearly define and support each startup, innovative project, and business incubator. A national committee, chaired by the minister responsible for startups and further established by Executive Decree No. 20-245 on December 21, 2020, underscores the government's commitment.

Although the startup culture in Algeria is nascent, with a focus primarily on consumer sectors such as goods and services transportation, the establishment of a ministry dedicated to the knowledge economy and startups, along with a funding mechanism for these entities, signifies a robust governmental endorsement of their potential role in economic diversification.

**3.3 Green Startups:**

Green startups are quintessential examples of social entrepreneurship within the green industry. They aim to mitigate environmental degradation or garner consumer support through innovative initiatives.
These enterprises are committed to sustainable operational practices, striving to embody eco-friendliness in every aspect of their business.

- Offering environmentally friendly products or services that provide alternatives to less sustainable options.
- Upholding rigorous environmental standards in their operations to ensure a net positive impact on the planet (Ben-Fadel, 2021).

**3.4 Funding Stages for Startups:**

Embarking on the startup journey begins with a kernel of an idea or a pressing problem that demands a solution. However, an idea alone does not suffice to launch a viable business; it requires a blend of time, discipline, dedication, and critically, substantial funding. Most startups depend on external financial backing, the extent of which varies with the development stage of the business.

**3.4.1 Pre-establishment Funding Stage:**
This initial phase, often referred to as the pre-seed or seed stage, represents the nascent operations of a startup, where it starts from the ground up. At this early juncture, equity exchange for investment might not yet be appealing to investors, prompting the company to bootstrap its early growth.
This stage typically precedes the more intensive pre-series funding phase and can see financial needs ranging from $10,000 to $1,000,000. Potential financiers during this pre-seed stage include:

- Startup founders themselves.
- Friends and family who believe in the venture.
- Early-stage venture capital funds that specialize in small-scale, high-risk investments.

**3.4.2 First Funding Stage:**
Following the pre-seed phase is the seed stage, where most startups find themselves depleting the initial capital raised during bootstrapping. This stage is critical for covering costs associated with launching the product and gaining early market traction.
It's a pivotal period that aligns with the development of a comprehensive marketing plan, involving:
_ Identification of potential target audiences and competitive analysis.
_ Execution of market tests to gauge product viability.
_ Refinement of the company's pitch deck to enhance investor presentations.
_ Selection of platforms for product launch announcements, including advertising sites and press releases.
_ Development of robust marketing strategies encompassing social media, intranet utilization, search engine optimization, link building, and blogging.

**3.4.3 Series A Funding Stage:**
At this point, the startup likely has a developed product and a growing customer base generating steady revenue, which supports expansion into new markets. The Series a funding round is the first major venture capital investment phase, involving:
_ Crafting a strategic plan focused on long-term profitability and sustainable growth.
_ Initial interactions with angel investors and venture capital firms.
_ Implementation of the 30-10-2 rule: targeting 30 investors, engaging 10 who express interest, and securing investment from 2.

**3.4.4 Series B Funding Stage:**
During the Series B stage, venture capitalists play a predominant role. Startups at this phase generally possess a revenue-generating business model, with valuations ranging from $30 million to $60 million, and are capable of raising approximately $30 million. This stage builds upon the foundations laid during Series A but shifts focus slightly towards:
_ Expanding market share through enhanced marketing and business development strategies.
_ Accelerating growth to cater to a broader customer base and to assert a competitive stance in the market. This phase also draws interest from a new cohort of later-stage venture capitalists who specialize in scaling already established startups (Sajid, 2021).

**3.4.5 Series C Funding Stage:**
At the Series C funding stage, startups seek additional financial resources to spearhead ambitious projects such as launching innovative products, penetrating new markets, or potentially acquiring other startups that are underperforming within similar sectors.
This stage attracts investors who are looking for higher returns on investments, as the operational risks associated with these companies have significantly diminished. Consequently, this funding round often draws a diverse array of financiers including hedge funds, investment banks, and private equity firms.
Startups that have demonstrated robust business growth and may boast valuations ranging from $100 million to $120 million are typically able to secure around $50 million during this phase.

**3.4.6 Series D Funding Stage and Beyond:**
The Series D funding stage is often approached with hesitation by many startups, as they weigh the benefits of maintaining independence against the potential of merging under

favorable terms. This stage offers a pathway for substantial expansion with financial backing primarily from late-stage venture capitalists, private equity firms, hedge funds, and banks. Startups in this stage are generally valued between $150 million to $300 million and can raise approximately $100 million to support their continued growth.

**3.4.7 Initial Public Offering (IPO) Stage:**

The Initial Public Offering (IPO) represents a pivotal moment for a startup, marking its transition from a privately held entity to a publicly traded company. This process is not only a mechanism for raising substantial capital but also provides an opportunity for earlier stage investors to realize a return on their investment. During the IPO, several critical steps are undertaken:

_ Formation of an IPO team comprising external experts such as underwriters, legal professionals, certified public accountants, and securities and exchange specialists.

_ Comprehensive compilation of the startup's operational, financial, and strategic data to present to potential investors.

_ Rigorous auditing of the financial statements to ensure transparency and reliability, culminating in a detailed report that supports the public offering's validity (Sajid, 2021).

**3.5 International Green Startups:**

Green startups have emerged as vital contributors to the economic landscapes of Western and East Asian nations, playing pivotal roles in environmental conservation.

These enterprises are increasingly recognized as essential components of any economic development strategy focused on sustainability. Entrepreneurs within this sector are instrumental in driving forward innovations that address both economic growth and environmental preservation.

**3.5.1 Startups in Germany:**

Germany hosts a thriving ecosystem for startups, particularly evident in cities like Berlin and Munich, where approximately 70,000 startups are based. The investment climate in Germany varies by location, with Berlin startups typically receiving around $1 million in initial funding, whereas in Frankfurt, the average initial funding is about $882,000.

The investment in critical technological infrastructures in Germany significantly exceeds global averages, reflecting the country's commitment to fostering innovative growth. During the COVID-19 pandemic, the German government implemented a support scheme valued at $2 billion to safeguard startups, ensuring the continuation of innovation through challenging times.

**3.5.1.1 Company Founder Benedikt Franke (Planetly):**

| Company Name | Year Founded | City | Financing value |
|---|---|---|---|
| Planetly | 2019 | Berlin | 5.7 Million dollars |

This startup, which employs between 1 to 10 individuals, has distinguished itself by developing a software tool that enables detailed analysis of carbon footprints across various sectors, including individuals, factories, and products. This tool quantifies carbon dioxide emissions in tons per year, providing valuable insights into environmental impact.

Planetly is at the forefront of offering solutions designed to reduce carbon emissions. As a company committed to environmental stewardship, its mission aligns with global efforts to mitigate the effects of global warming, emphasizing sustainable practices and technologies (Larine, 2019).

### 3.5.1.2 German Company Criplus:

| Company Name | Year Founded | City | Financing value |
|---|---|---|---|
| Criplus | 2018 | Hamburg | 3.7Million dollars |

Founded by innovators Christian Schiller and Volkan Bilici, Criplus has carved a niche in the global market by dealing with recycled and raw waste materials. Employing cutting-edge blockchain technology alongside sophisticated artificial intelligence algorithms, Criplus ensures the meticulous management of plastic materials, directly addressing the pervasive global issue of plastic waste. The company's platform meticulously handles every facet of the acquisition process for these recycled materials, streamlining operations and enhancing efficiency.

### 3.5.2 Green Startups in Brazil:

| Company Name | Year Founded | City | Financing value |
|---|---|---|---|
| Moss Earth | 2020 | Sao Paulo | 3.7 Million dollars |

In Brazil, a pioneering green startup has created a lucrative business model focused around the trading of carbon credits via its dedicated platform. This innovative approach encourages corporations to adopt more environmentally friendly practices by facilitating the trade of carbon credits, a concept that gained prominence after the Paris Climate Meeting.

Essentially, this trade allows high-emission countries to buy emission rights from those with lower emissions, effectively monetizing the act of pollution. Since its inception, this startup has successfully completed three funding rounds, securing six investors and raising an impressive total of approximately $13.4 million, as detailed in the 2022 Fybish report titled "Top Startups by Country" (Fybish, 2022).

### 3.5.3 Italian Green Startups:

Italy, renowned globally as a prime vacation spot, is also emerging as a significant player in the startup ecosystem, particularly leveraging its influence in the global fashion industry. The country is home to approximately 12,000 startups, with investment figures varying significantly by location. On average, Italian startups receive about $433,500 in seed funding, while Series a funding rounds can amount to about $950,000, both of which are somewhat below the global average (Fybish, 2022).

### 3.5.3.1 Exo lab italia, an Italian Green Startup:

| Company Name | Year Founded | City | Financing value |
|---|---|---|---|
| Exo Lab italia | 2020 | l'Aquila | 0.5Million dollars |

Exo lab Italia, founded by Lorenzo Secli, is at the forefront of integrating sustainability with cutting-edge technology. The startup specializes in harnessing plant-based secondary vesicles extracted from organic fruits and vegetables to develop a range of sustainable and organic products. This innovative use of nanotechnology -a field that manipulates matter at an atomic and molecular level -allows for ground breaking advancements in product development, focusing on sustainable solutions that are measured in fractions of a millimeter (Exolabitalia, 2020).

**Conclusion**

The traditional linear economy has increasingly shown its limitations and unsustainability, often culminating in environmental disasters that trigger natural calamities such as floods and exacerbate climate change, a critical challenge of the 21st century. Decades of climate research have conclusively linked human emissions to these environmental catastrophes, with projections indicating continued adverse impacts in future decades. As humanity grapples with these dire consequences, various entities are actively pursuing climate protection measures through innovative solutions and limiting the production of climate-impacting products.

The advent of the Fourth Industrial Revolution has empowered innovators and entrepreneurs to actualize their visions, utilizing ground-breaking technologies such as artificial intelligence, the Internet of Things, and nanotechnology to significantly enhance sectors like mineral recovery and data analytics for recycling and reuse purposes. In the Arab world, while startups are present, they often lack specialization in the green economy, with potential areas of investment including diverse sectors such as e-commerce, the fitness industry, online English language learning platforms for students, and facilitating accessible investments in the American stock market for the average person.

In Algeria, the green startup concept is still in its infancy, with the legislative environment yet to fully embrace this sector. The high cost of products, specialized equipment, and the intensive time and risk associated with developing these enterprises pose significant challenges to their growth and viability.

**Recommendations:**

- Encourage green startups within a special legal framework and finance green innovators through interest-free loans or partnerships between innovators and banks.
- Governments should support such companies to diversify economically and reduce reliance on the hydrocarbon economy. Algerian companies should adopt modern technologies to recycle carbon emitted from burning natural gas and utilize it in manufacturing.
- Algerian startups should apply the 30-10-2 principle and exploit the internet for marketing their innovations, especially in environmental services.

**References**

Abdel Karim Kaki (2020). The New Trilogy: Green Innovation, Green Economy, and the Issue of Sustainable Development in Small and Medium Enterprises, Management & Revue Economie.

Arsalan Sajid (July 17, 2021). The Startup Funding Stages You Should Know. Retrieved March 19, 2022, from Cloudways: https://www.cloudways.com/blog/startup-funding-stages

Asaf Fybish (2022). Top Startups by Country, from Startup Stash: https://startupstash.com/italian-startups

Asaf Fybish (2022). Top Startups by Country, Retrieved March 22, 2022, from Startup Stash: https://startupstash.com/brazilian-startups

Baroudi Mafroum (2021). Startups in Algeria and Expectations, Annals of the University of Béchar in Economic Sciences.

Egyptian Environmental Affairs Agency (2022). Environmental Topics, Retrieved March 25, 2022, from Egyptian Ministry of Environment: https://www.eeaa.gov.eg/ar-eg/ موضوعات بيئية/ الإدارة البيئية/ الاقتصاد الأخضر.aspx

Eric Ries (2011), The Lean Startup, New York: Crown Business.

Executive Decree No. 20-245 dated 3 Safar 1422 AH corresponding to December 21, 2020, Official Gazette of Algeria, Issue No. 55.

Exolabitalia (2020). Inside Nature, Retrieved March 22, 2022, from: https://exolabitalia.com

G20 Agreement (August 25, 2021). Exceptional Outcomes of the G20 in an Exceptional Year, Retrieved 2022 from the Saudi National Platform for Government Services: https://www.my.gov.sa/wps/portal/snp/content/ExceptionalOutcomes

Larine Fink (2019). Smart Carbon, Retrieved March 20, 2022, from Planetly: https://www.planetly.com

Michael E. Mann (March 2022). Global Warming, Earth Sciences. Retrieved from Britannica: https://www.britannica.com/science/global-warming

Mustafa Abdel Monem Qamar (2012). The Population Explosion and Global Warming - Kuwait, World of Knowledge.

Rakia Haddadou (2021). Green Finance as One of the Tools of the Green Economy to Achieve Sustainable Development in Algeria, Al-Muqrizi for Economic and Financial Studies.

Sara Madi (2021). Green Startups as a New Trend Towards Increasing Sustainable Business - The German Experience, Legal and Economic Studies.

Saudi Aramco (2022). The Company's Approach to Sustainability, Retrieved 2022 from Aramco: https://www.aramco.com/ar/sustainability/our-approach-to-sustainability

United Nations (April 22, 2021). Paris Agreement. Retrieved March 27, 2022, from Climate Action: https://www.un.org/ar/climatechange/paris-agreement

Wasila Ben Fadil (December 31, 2021). Green Startups as a Form of Sustainable Innovation Between Environmental Challenges and the Opportunity to Enter Sustainable Business Fields - Case Study of the Startup Aquavate in Béchar, Journal of Economic Integration.

Wil Schroter. Retrieved from Startups.com: https://www.startups.com/community/experts/901/wilschroter

Yahya Muhammad Nabhan (2013). Global Warming and its Impact on the Environment - Jordan, Dar Kunooz Al-Ma'arifa Scientific for Publishing and Distribution.